



EXAM PAPERS PRACTICE

Studying cells 2

Level: AQA A Level 7402

Subject: Biology

Exam Board: Suitable for all boards

Topic: Studying cells 2

Type: Mark Scheme

To be used by all students preparing for AQA A Level Biology 7402 foundation or higher tier but also suitable for students of other boards.

Mark schemes

1 (a) Correct answer: 1.25;
Ignore working

OR (if wrong answer)

$$\frac{\text{measurement in } \mu\text{m}}{40000} / \frac{\text{measurement in mm}}{40} = 1 \text{ mark}$$

125 but wrong order of magnitude = 1 mark

2

(ii) **C** has myosin / thick (and actin / thin) filaments;

OR

A has only actin / thin (/ no myosin / no thick) filaments;

1 max

(b) When contracted:

Thick & thin filaments/myosin & actin overlap more;

Interaction between myosin heads & actin / cross-links form;

Movement of myosin head;

Thin filaments / actin moved along thick filaments / myosin;

Movement of thin filaments / actin pulls Z-lines closer together;

Displacement of tropomyosin to allow interaction;

Role of Ca^{2+} ;

Role of ATP;

*Allow ref. to 'sliding filament mechanism' /
described if no other marks awarded*

4 max



EXAM PAPERS PRACTICE

- (c) (i) 8 has DMD but 3 and 4 do not / 12 has DMD but 6 and 7 do not / neither parent has the condition but their child has;
Allow parents 3 and 4 give 8, parents 6 and 7 give 12 1
- (ii) 4 **AND** 7; 1
- (iii) Parental genotypes: 6 = $X^D Y$ AND 7 = $X^D X^d$
AND
Gametes correct for candidate's P genotypes – e.g.
 X^D and Y + X^D and X^d ;
Offspring genotypes correctly derived from gametes e.g.
 $X^D X^D$ + $X^D X^d$ + $X^D Y$ + $X^d Y$;
Male offspring with MD correctly identified: $X^d Y$;
Probability = 0.25 / correct for candidates offsprings genotypes;
Accept 1/4 / 1 in 4 / 1:3 / 25%
NOT 3:1 / 1:4 4
- (d) (i) No gene fragment **G**; 1
- (ii) Only one copy of gene fragment **F**;
Male has only one X-chromosome / is XY
(c.f. female has two / is XX); 2
- (iii) 10 has only one copy of gene fragment **G**;
10 has only one normal X-chromosome / has one abnormal /
has only one normal allele / has one X^d / is $X^D X^d$ / is heterozygous;
11 has two normal X-chromosomes / has 2 normal alleles /
is $X^D X^D$ / has not got X^d / has 2 copies of (F and) G; 3
- (e) (i) To prevent rejection / prevent antibody production vs. injected cells /
injected cells have (foreign) antigen (on surface); 1
- (ii) Shows effect of cells / not just effect of injection / not just effect of
salt solution; 1



- (iii) Only one person tested so far – need more to see if similar results / need more to see if reliable;

Need to assess if new (dystrophin positive) muscle fibres are functional / if muscle becomes functional;

Can't tell how widespread effect is in the muscle / sample taken near injection site;

Need to test for harmful side effects;

Need to test if successful for other mutations of dystrophin gene;

Need to assess permanence / longevity of result/insufficient time allowed in investigation;

(In this patient) only small response / %;

Further sensible suggestion;

4 max

[25]



- 2** (a) Differentiation / specialisation 1
- (b) (i) (cellulose) Cell wall; 1
- (ii) Two marks for correct answer 2350–2500;;
Accept measured and real lengths in different units for one mark.
One mark for a measured length divided by real length; 2
- (iii) Chloroplasts absorb light;
Q Do not accept chlorophyll as alternative to chloroplasts
- Or
- Large vacuole pushes chloroplasts to edge (of cell);
- Or
- Thin / permeable (cell) wall to absorb carbon dioxide; 1 max
- [5]**
- 3** (a) Single layer of cells / few layers of cells;
So that light that can pass through / cells absorb light; 2
- (b) Method of determining area of field of view / area seen using microscope;
Count number of stomata in field of view;
Repeats and calculation of mean; 3
- (c) Water vapour accumulates / increased humidity / reduced air movement (around stomata);
Water potential / diffusion gradient reduced; 2
- [7]**
- 4** (a) (Group of) similar / identical cells / cells with a common origin;
Q Ignore references to function 1
- (b) (i) Add iodine / stain specific for starch to the slide / cells / tissue / add iodine / stain specific for starch and examine under microscope;
Blue-black / blue / black / purple;
Reject sample 2



- (ii) Need a single layer of cells / only a few cells thick / not too many layers / detail obscured by cells underneath;

Light must be able to pass through;

2

- (c) Both are polymers / made of monomers;

Joined by condensation / molecules can be broken down by hydrolysis;

Both have 1-4 links;

Contain C(arbon), H(ydrogen) and O(xygen) / both made up of glucose;

Both insoluble;

Both contain glycosidic bonds;

Accept other valid answers.

Ignore ref to unbranched.

2 max

[7]

5

Advantages:

- 1 Small objects can be seen;
- 2 TEM has high resolution as wavelength of electrons shorter;

Accept better

Limitations:

- 3 Cannot look at living cells as cells must be in a vacuum / must cut section / thin specimen;
- 4 Preparation may create artefact
- 5 Does not produce colour image;

[5]

6

- (a) To ensure the colour is the same at the start;

1

- (b) Yes – curve on graph with bromelain present remains approximately constant / rises very slightly;

Would decrease if killing of cells occurred / would increase if cells still dividing;

2

- (c) Use of mouse cells (rather than human);
(Carried out) *in vitro* / not in living organisms;
Only tested on one type of cancer;
Not possible to predict effect on humans (as no data collected);

3 max



(d) The faster the rate of division the faster the cancer would grow;
By measuring rate of cell division you could see how effective the treatment was;

2

(c) Not ethical to replace conventional treatment;
As life of patient is at risk (if bromelain not effective);

2

[10]

7

(a) (i) break open cells / release cell contents;

1

(ii) keep pH the same / controls pH;
prevent change to / denaturing of proteins / enzymes;

2

(b) (i)

2

(ii) site of respiration which releases energy / ATP;
required for movement against concentration gradient;
*ignore first point for thermodynamically incorrect statements
such as "making energy".*

2

[7]

8

(a) Several / more than one polypeptide chain in molecule;

Evidence must only relate to 4^o structure

1

(b) Chemical bonds formed between sulphur-containing groups /
R-groups / form stronger disulphide bonds;
Bind chain(s) to each other;

2

(c) Different number / sequences of amino acids;
Bonds in different places which gives different shape;

2

(d) Outer layer of skin cells are dead / do not respire
Do not contain mitochondria / do not produce ATP / release energy;
Cells do not have required proteins / carriers;

3

(e) Advantages:

- 1 Small objects can be seen;
- 2 TEM has high resolution as wavelength of electrons shorter;
Accept better

Limitations:

- 3 Cannot look at living cells as cells must be in a vacuum;
- 4 must cut section / thin specimen;
- 5 Preparation may create artefact
- 6 Does not produce colour image;

6
[14]

9

(a) (i) Chloroplast;

1

(ii) Photosynthesis;

Uses light (energy);

To produce carbohydrates / starch / glucose / sugars / ATP /
reduced NADP;

*Note that candidates cannot be expected to have a detailed
knowledge of photosynthesis.*

max 2

(b) (i) **A**;

1

(ii) **C**;

1

(c) (i) Slows enzymes / prevents enzymes being denatured /
prevents / stops self-digestion;

Ignore references to bacteria. Reject enzymes not working

1

(ii) To remove organelle C / nuclei;
Which are larger / more dense;

2

[8]



- 10** (a) removes debris / intact cells / sand;
which would contaminate sediment A / interfere with the results; 2
- (b) (i) nuclei; 1
- (ii) ribosomes / endoplasmic reticulum / membrane / Golgi; 1
- (c) density / size / mass / weight; 1
- (d) an electron microscope has a higher resolution;
electrons with shorter wavelength; 2
- [7]**
- 11** (a) 1. e.m. gives high resolution due to short wavelength of electrons;
2. antibodies attach specifically to target proteins;
3. gold particles are electron dense;
4. electrons must pass through a vacuum so material must be dead / fixed for e.m.;
5. cross-bridge cycling requires living cells / metabolism / named aspect-e.g. ATP
synthesis; 5
- (b) 1. Ca^{2+} removes blocking molecules / uncovers binding site on actin;
2. correct references to Ca^{2+} binding to troponin / moving tropomyosin;
3. allows myosin heads to attach to actin filaments;
4. allows sliding of the actin and myosin filaments;
5. binding of ATP causes myosin (head) to detach (from actin);
6. (hydrolysis of) ATP releases energy;
7. which changes the configuration / cocking of the myosin head;
- 5 max**
- [10]**
- 12** (a) (i) Mitochondria site of respiration;
Production of ATP / release of energy;
For contraction;
Do not award credit for making or producing energy. 3
- (ii) Enzymes are proteins;
Proteins synthesised / made on ribosomes; 2
- (b) Lysosomes produce / contain enzymes;
Which break down / hydrolyse proteins / substances / cells of tail; 2



- (c) 1. Chop up (accept any reference to crude breaking up);
2. Cold;
3. Buffer solution;
4. Isotonic / same water potential;
5. Filter and centrifuge filtrate;
6. Centrifuge supernatant;
7. At higher speed;
8. Chloroplasts in (second) pellet;

max 6

[13]

13

(a) (i) Golgi;

1

(ii) Exocytosis;

1

- (b) (i) Joining together of amino acids / synthesis / production of thyroglobulin / makes protein;

Do not credit synthesis of amino acids

1

- (ii) Electron microscope has high / greater resolution;
Because it uses electrons which have smaller wave(length);

2

[5]

14

- (a) (i) A mitochondrion and B nucleus;
(*need both for one mark*)

1

- (ii) increased surface area;
for respiration / enzymes;

2

- (b) *any suitable feature*
e.g. plasmid / capsule / 70S ribosomes / smaller ribosomes / complex cell wall / mesosome / no nucleus;

1

- (c) use of differential centrifugation / or description;
first / low-spin pellet discarded / spin at low speed to remove cell wall material / cell debris;
supernatant re-spun at higher speed / until pellet with chloroplasts is found;
method of identifying chloroplasts e.g. microscopy;

3 max

[7]



15

- (a) two environmental or developmental variables and explanation;

examples,

all plants of the same age, so same time for cell divisions / differentiation;
all plants given the same watering, so same amount of water for cell expansion;

(reject reference to photosynthesis)

all plants given same light, so same rate of photosynthetic;
same temperature, so enzymes / named metabolic process at optimum temperature;

same named ion / minerals in soil(e.g. nitrate),
so same available for a named function,
(e.g. amino acid / protein synthesis);

2 max

- (b) count cells using microscope;
count number of cells in cell division / where chromosomes visible;
and then the total number of cells in field of view;

2 max

- (c) only cells at tip have ability to divide / cells further back don't divide;
cells further back differentiating / named example of
(accept reference to loss of totipotent cells)
differentiated tissue / too old / reduction in plant hormone;
cell wall too thick / vacuole too large to allow division;

2 max

- (d) new cells added at tip;
cells increase in volume / larger;
increase in length (of cells);
as vacuoles get larger;
due to uptake of water (by osmosis);

3 max

[9]

16

- (i) cold - no / reduced enzyme action / e.g. stops autolysis;
(reject "cell activity reduced")

isotonic - stops osmotic effects / description of effect on cells or organelles;

buffer - prevents damage to enzymes / proteins;

3

- (ii) break open the cells / release the cell contents;

1

- (iii) supernatant / liquid above the pellet;
spun at a high(er) speed;

(mark as independent points)

2

[6]



- 17** (a) (i) homogeniser / blender / pestle and mortar / description
e.g. grind with sand; 1
- (ii) centrifuge / description e.g. spin at high speeds; 1
- (b) (i) chloroplast; 1
- [3]**
- 18** (a) (i) microvilli; (*reject brush border*) 1
- (ii) increased surface area (for diffusion); 1
- (b) (i) $\frac{16 \times (1000)}{0.1}$ principle of $\frac{\text{measuring scale bar}}{\text{dividing by } 0.1}$;
(15 – 17 tolerance) 160000;
(*correct answer award 2 marks*) 2
- (ii) electron microscope has a greater resolving
power / objects closer
together can be distinguished;
electron (beams) have a shorter wavelength; 2
- (c) short diffusion pathway / short pathway to the centre / large SA:V ratio
for faster, more diffusion; 1
- [7]**
- 19** (a) X = mitochondria;
Y = (rough) endoplasmic reticulum;
Accept ribosomes/ER/RER for Y
Reject smooth endoplasmic reticulum for Y 2



- (b) (i) (Sections cut at) different angles/in different planes;
Ignore name given to organelle 1
- (ii) Z modifies/packages/transport/secret/ Z adds sugars to proteins;
X provides ATP/energy (for this);
Accept makes in relation to Z but not X
Ignore names of organelles if function correct 2

[5]

20

- (a) (i) Mitochondrion;
Neutral: cristae 1
- (ii) (Site of aerobic) respiration / ATP production / energy release;
Q Reject: anaerobic respiration
Q Reject: energy produced
- Active transport / transport against the concentration gradient;
Accept: energy produced in the form of ATP 2

- (b) 89 – 91 gains 2 marks;
Correct answer gains 2 marks outright

Principle of:

$\frac{\text{correct measured length}}{\text{magnification}}$ gains 1 mark;
89-91 (mm) / 1000 or 8.9-9.1 (cm) / 1000 gains 1 mark 2

- (c) Suitable explanation given e.g.
Accept: converse arguments
- Reduced surface area; (So) less absorption;
Neutral: structure Z incorrectly named
- (Membrane-bound) enzymes less effective;
(So) proteins / polypeptides not digested;
Reduced surface area for absorption gains 2 marks
- Cell membranes damaged;
(So) Fewer / less effective carrier / channel proteins;
Accept: references to diffusion and active transport for 'absorption'
- Carrier / channel proteins damaged;
(So) less absorption;
Reject: active transport if linked to channel proteins 2

[7]